REMARKS/ARGUMENTS

Claims 1-11 are pending in this application. Claims 1, 3-7 and 9-11 stand rejected under 35 U.S.C. §102(b) as being anticipated by Donahue U.S. 6,177,783. Furthermore, claims 1, 3-7 and 9-11 stand rejected under 35 U.S.C. §102(b) as being anticipated by Kubach et al. U.S. 4,293,812.

Claims 2 and 8 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Donahue in view of Minks, U.S. Patent No. 4,791,349. Claims 2 and 8 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kubach et al. in view of Minks.

The present invention relates to an ORing circuit which allows multiple power supplies to be coupled together. Each power supply provides power to a common point. If any supply fails, power is still provided to the common point by the other supply or supplies. A circuit is coupled in series with each power supply to the common point. The circuit preferably utilizes a MOSFET transistor. The circuit is superior to conventional diode ORing circuits because the on resistance of the MOSFET is significantly lower than the typical higher forward voltage drop of a diode. In today's microprocessor power supplies, which typically provide voltages of approximately one volt to two volts at high currents, the forward voltage drops of conventional diodes are too high, i.e., they represent too great a fraction of the total output voltage. Accordingly, they cannot be used efficiently in modern microprocessor power supply circuits.

In contrast, the forward on resistance of a MOSFET is very low and the present invention operates the MOSFET as a replacement for the diode.

However, in order to use a MOSFET in such an application, it is necessary to be able to prevent reverse current. For example, if one power supply shorts, if a conventional diode is utilized, the diode would automatically block the reverse current because it would be reverse biased. However, with a MOSFET, if the gate is controlled on and one power supply shorts, a reverse current will flow from the other supplies because the MOSFET is bi-directional when the gate is on. It is thus necessary to be able to determine if a reverse current will flow and quickly turn the MOSFET off so that the reverse current will not flow through the MOSFET channel. Accordingly, the present invention utilizes a current direction determination circuit to turn the MOSFET off in the event of a reverse current. Furthermore, it is also necessary and desirable, for good regulation, to maintain the voltage drop across the switching transistor element constant

independently of the current magnitude within a predefined range. The present invention uses an amplifier circuit 100 having its inputs across the power transistor or transistors in a feedback loop to regulate the voltage across the power transistor or transistors. An amplifier 205 is coupled across the source-drain terminals of the switching transistor or transistors 1, 2, N and through a regulation loop controls the gate voltage to maintain the predetermined voltage across the source-drain terminals. See Fig. 1.

In the Office Action, the Examiner has rejected the claims, and in particular, the independent claim 1 based upon references to Donohue U.S. 6,177,783 and Kubach et al. U.S. 4,293,812 (Kubach). The Examiner has also made obviousness rejections of some of the dependent claims, each of which includes the Donohue or Kubach references.

Donohue discloses a current balancing circuit for a voltage regulator. The circuit includes a plurality of current regulators 204 each connecting a respective power supply to a common point. However, the Donohue circuit could not be used as an ORing circuit with the type of low voltage, high current power supplies contemplated by the present invention.

Donohue requires a diode D1, D2 to prevent reverse current in the event of power supply failure. See column 4, lines 41-47. Thus, Donohue never anticipates turning off the MOSFET to prevent reverse current flow. Further, because Donohue has this diode, his circuit always has a large forward voltage drop, and thus could never be used with low voltage power supplies producing, for example, 1-2 volts for microprocessors, as the inefficiency would be too great. The present invention does not use diodes but instead controls the MOSFET to reduce forward losses. Accordingly the Donohue circuit does not teach or suggest the reverse current prevention by controlling the transistor element as claimed.

The Kubach circuit is not an ORing circuit for connecting multiple power supplies to a common point and accordingly, there is no need to turn off the transistor element since there is no possibility of a reverse current because there are no multiple power supplies. Note in Fig. 5 of Kubach that both regulator transistors are connected to the same power supply source U_E. Further, Kubach shows a bipolar device, which would not allow bidirectional current flow if the connected power supply failed, even if the Kubach circuit were connected in an ORing type circuit (for which there is no suggestion anyway).

Accordingly, neither reference, alone or in combination, discloses or suggests the features of claim 1 or 7, and it is submitted that claims 1-11 are patentable over the cited references.

New claims 12 and 13 have been added.

In the present invention, the source-drain voltage of the transistor element is monitored so that the source-drain voltage is maintained constant independent of the current magnitude over a predefined range. The present invention is directed to an ORing circuit. The aim is to have a low voltage drop in the circuit and to maintain that drop constant over the predefined current range. The present invention does not require a current sensing resistance in series with the monitored transistor. Both Donohue and Kubach describe voltage regulator circuits, which rely on an external sense resistor (R1, R2 in Donohue and RCU in Kubach). In Kubach, RCU is the intrinsic resistance of the inductor L. In a regulation loop, the voltages across these impedances are monitored to control the control electrode voltage of the power transistor in the regulator.

In the Donohue circuit, the voltage across the impedance, i.e., the resistor, is maintained constant to maintain a constant current through the regulator. This is not the same as in the present invention wherein the transistor element is controlled in such a manner that a preselected voltage drop is produced across the transistor element independently of the current magnitude. In the Donohue circuit, each of the current regulators produces a constant current output as measured by the voltage across the resistance. An error amplifier at the common node of the Donohuc circuit varics thc gatc voltagcs of the MOSFETs Q1 and Q2 to establish selected currents in a preset ratio in the current regulators. The Donohue circuit maintains a current balance between the plural regulators using a common control signal from the error amplifier. However, the Donohue circuit does not seek to maintain the voltage across the switches Q1, Q2 constant, as does the present invention.

In particular, in the present invention, the voltage across the transistor is monitored to maintain that voltage constant independent of the current passing through the transistor within the predefined range. As the current increases, the circuit of the present invention will maintain the source-drain voltage at a constant level.

In the circuit of the Kubach reference, an impedance RCU in series with the bipolar transistor switch 11 is monitored to control the base voltage of the bipolar transistor switch to maintain regulation. The main terminals (emitter-collector voltage of the switch) are not

monitored, so the Kubach et al. reference also does not meet the claim limitation of claims 12 and 13 of controlling the transistor element such that a preselected voltage drop is produced across the transistor element independently of the current magnitude.

Accordingly, it is submitted that new claims 12 and 13 are also patentable over the cited references for the additional reasons discussed.

The claims are submitted to be patentable over the references for the reasons stated above. However, the claims have been amended to improve their clarity. New claims 12 and 13 have been added to further define the invention.

In view of the above, Applicant submits that all claims in this application are now in condition for allowance, prompt notification of which is requested.

Respectfully submitted,

THIS CORRESPONDENCE IS BEING SUBMITTED ELECTRONICALLY THROUGH THE PATENT AND TRADEMARK OFFICE EFS FILING SYSTEM ON February 7, 2008.

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